

diameter recited in claim 5, can be found on page 7, lines 20-21. Claim 20 has been amended to be in independent form.

The following sections correspond to the sections of the outstanding Office Action.

Issues Under 35 USC 112, first paragraph

Claim 20 remains rejected under 35 USC 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention. Applicants respectfully traverse the rejection.

Specifically, the Examiner does not find support in the specification for the phrase "a powder Raney catalyst" to be used for a fixed bed. In response, Applicants have amended claim 20 to be in independent form. Claim 20, as presently amended, does not recite that the powder Raney catalyst is used in a fixed bed.

Thus, one skilled in the art would come to the reasonable conclusion, that the inventors, at the time the application was filed, had possession of the claimed invention. Therefore, Applicants respectfully request that the rejection be withdrawn.

Issues under 35 U.S.C. § 112, second paragraph

Claims 1, 5-6, 8, and 18-20 stand rejected under 35 U.S.C. § 112 second paragraph as being indefinite. Applicants respectfully traverse the rejection.

The Examiner objects to the term "powder type" as appearing in line 1 of claim 1. In response, Applicants have amended claim 1, by replacing "powder type" with "powder".

The Examiner objects to claim 5 for not clearly setting forth the classification of the particles to be used in the last activation step. In response, Applicants have deleted the classification step from claim 5.

The Examiner objects to claim 20 for not clearly setting forth whether the powder Raney catalyst is used in a fixed bed. In response, Applicants have amended claim 20 to be in independent form. Also, claim 20 does not recite that the powder catalyst is used in a fixed bed.

Accordingly, Applicants respectfully submit that the claims, as presently amended, particularly point out and distinctly claim the subject matter that Applicants regard as the invention. As such, Applicants respectfully request that the rejection be withdrawn.

(I) Issues Under 35 USC 102 and 103

(I) (A) The following rejections are pending:

(1) Claims 1, 5, 18 and 20 are rejected under 35 U.S.C. §102(e) as being anticipated by or, in the alternative under 35 U.S.C. §103(a) as obvious over **Schuetz et al.** (US 5,536,694);

(2) Claims 5, 8 and 19 stand rejected under 35 U.S.C. §103(a) as being unpatentable over **Schuetz et al.**;

(3) Claims 6 stands rejected under 35 U.S.C. §103(a) as being unpatentable over **Schuetz et al.** and further in view of **Lepper et al.** (US 4,520,211);

(4) Claims 1, 5, 8-10 and 18-20 stand rejected under 35 U.S.C. §103(a) as being unpatentable over **Schuetz et al.** in view of **Raney** (US 1,628,190) and optionally further in view of **Richter** (US 3,673,116);

(5) Claim 6 stands rejected under 35 U.S.C. §103(a) as being unpatentable over **Schuetz et al.** in view of **Raney** optionally in view of **Richter** and further in view of **Lepper et al.**;

(6) Claims 5, 6 and 8 stand rejected under 35 U.S.C. §103(a) as being unpatentable over **Diffenbach et al.** (US 3,719,732) in view of **Lepper et al.**; and

(7) Claims 1, 5, 6, 8 and 18-20 stand rejected under 35 U.S.C. §103(a) as being unpatentable over **Diffenbach et al.** in view of **Lepper et al.** and further in view of **Schuetz et al.**

Applicants respectfully traverse each of the rejections.

(I) (B) - Rejections (1)-(5)

In each of the rejections (1)-(5), **Schuetz et al.** is the primary reference. The Examiner has taken the position that if

Applicants are able to distinguish the presently claimed catalyst from the teachings of Schuetz et al., that the Examiner would withdraw rejections (1)-(5). More specifically, the Examiner notes that claims 1, 5-10 and 18-21 are in the product-by-process format, and as such, the process limitations will be given more patentable weight after the process limitations are shown to actually form a product which is distinct from the product produced by the prior art. The following comments address this issue raised by the Examiner.

(I) (B) (i) -

In Applicants' December 13, 2000 Amendment, Applicants argued that the binder used in the production of the catalyst disclosed by Schuetz et al. is added for the purpose of making a molded catalyst with a bond between the powder type catalytic alloy particles. This binder does not contain the metallic ingredients dissolved out by alkali treatment such as aluminum, zinc, silicon. A binder such as used in Schuetz et al. does not contain the ingredients that were dissolved and removed during activation of the catalyst, and therefore, the binding portions do not function as a hydrogenating agent.

In response, the Examiner points to Table 1 wherein Schuetz et al. indicate that aluminum is removed from the binder.

In response, Applicants respectfully submit that the listing of aluminum in Table 1 refers to the amount of aluminum in the catalyst, not the binder. The elements in the binder are described in the Table of column 7. Schuetz et al fail to teach or suggest that these binder elements are leachable. As such, the skilled artisan would reasonably conclude (contrary to the Examiner's position) that the binder used in the production of the catalyst disclosed by Schuetz et al. is added for the purpose of making a molded catalyst having a bond between the powder type catalytic alloy particles and do not contain the metallic ingredients dissolved out by alkali treatment such as aluminum, zinc, and silicon.

(I) (B) (ii) -

The Examiner has taken the position that Applicants have not established a distinction between the structure of the inventive catalyst and the catalyst of Schuetz et al '694. Furthermore, the Examiner has taken the position that the binder of Schuetz et al '694 is formed of Raney metal, see the fourth full paragraph of page 14 of the outstanding Office Action.

Applicants now address the present claims on an individual basis, to explain the distinctions between the inventive structure of the catalyst and the structure of the catalyst of Schuetz et al.

(1) Distinctions between **claim 5** and Schuetz et al.

There is a substantial difference between a catalyst described in present claim 5 and the catalyst disclosed by Schuetz et al. In the present invention, a lump form catalyst alloy is obtained by completely melting a catalyst metal which is to be a raw material of the catalyst alloy and by quenching the melted alloy. In contrast to this, the catalyst of Schuetz et al. is a molded catalyst obtained by sintering the mixture of catalyst alloy powder and catalyst metal powder.

Moreover, the present invention relates to a catalyst alloy which is manufactured by the steps of melting the catalyst raw material, quenching, activating and the like. On the other hand, the invention disclosed by Schuetz, et al. relates to a molded catalyst obtained by adding a binder to the already formed catalyst alloy and sintering it. Specifically, Schuetz et al. have not disclosed any concrete manufacturing steps for the catalyst alloy.

The term "sintering" refers to an operation that heats the substance to a temperature of the melting point or less, thereby causing pyrolysis or a phase transfer which is different from

melting. That is to say, the "sintering" is entirely different operation from "melting" since "sintering" indicates a process at a temperature below the melting point or at a temperature which results in the formation of a minor liquid phase.

It would be clear to the skilled artisan that the distinctions between the inventive method of melting the catalyst alloy raw material, and the sintering method of Schuetz et al, result in very different catalysts.

As for the catalyst of Schuetz et al., a molded catalyst having certain strength properties is obtained by "sintering" causing densification between the powders without being entirely melted. However, as described above, since the raw material is not completely melted, it is a molded catalyst manufactured by anchoring the powder particles with a binder, that results in a porous catalyst.

Schuetz et al. disclose in column 4, lines 51-56:

The final molded items are optionally dried to constant weight at temperatures between 80° and 120°C, and then calcined at temperatures below 850°C, preferably between 500° and 700°C., in air in continuous or batch operated kilns such as rotary kilns or stationary kilns. The organic additives then burn off and leave behind a corresponding pore system.

It is clear from this passage that the final catalyst has pores.

Also, these temperatures that Schuetz et al. use in the "sintering" step is less than 850°C, preferably in the range of 500 to 700°C. Since this temperature is lower than the temperature at which nickel powder (used in the binder) and the catalyst alloy will melt, the skilled artisan would reasonably conclude that Schuetz et al. do not intend to completely melt the catalyst.

Now Applicants turn to the raw material of the molded catalyst of Schuetz et al. In the catalyst of Schuetz et al., there are at least two kinds of powders acting as the raw material of the binders, i.e., catalyst metal powders and catalyst alloy powders. These raw material powders are uniformly mixed in the presence of a wetting agent and a molding auxiliary, and molded in a specific shape (for example, a lump form) by a molding machine.

In addition, the molding material used in the binder of Schuetz et al. is a powdered pure substance of one component of the catalyst alloy; therefore, it is different from a catalyst alloy.

In column 5, lines 16-20, Schuetz et al. teach:

In contrast, sintering the catalyst alloy powder without adding the metal binder leads to molded items which partially disintegrate or "decompose" during leaching and in which the activated layer has only a low resistance to abrasion.

Therefore, Schuetz et al. require that the conditions be such to avoid a partial melting and adding the binder does not allow this unwanted partial melting to occur.

Moreover, Schuetz et al. teach the use of an organic additive which is burned off at the time of sintering resulting in the porous matrix.

Thus, the catalyst of Schuetz et al. is an aggregation of powders and is substantially porous in form.

On the other hand, the catalyst of the present invention is substantially uniform, since it is melted. In the melt state, the metallic elements mix on an atomic level. The obtained lump form catalyst is not an aggregation of powders, it is rather a catalyst alloy having a uniform mixture that is nonporous.

As described in the present specification, the inventive catalyst alloy is made at a ratio of nickel to aluminum in the alloy of 1:2 to 2:1 (see claim 8). It is clear from the phase diagram of Ni-Al (attached to Applicant's December 13, 2000 Amendment), that the melting temperatures, 950°C to 1600°C, of a catalyst alloy set at the inventive Ni-Al ratio are much higher than the temperatures (less than 850°C, preferably in the range of 500 to 700°C) used by Schuetz et al. in their sintering process.

Thus, the catalyst according to the present invention is clearly different from the powdered anchoring substance of Schuetz

et al. since; 1) the inventive catalyst raw material is completely melted in a high temperature state, and 2) the inventive catalyst raw material is a uniform mass of metal alloy.

At the time when the inventive catalyst is activated, an activation layer is made in a uniform thickness on the catalyst surface layer (see the electron microscope photograph attached to Applicants' December 13, 2000 Amendment). In contrast to this, Schuetz et al. make it clear that

After calcination the molded items are activated by leaching the aluminum using caustic soda solution. A 20% strength sodium hydroxide solution warmed to 80°C. can be used for this purpose. In this case, treatment for 2 hours leads to an active outer layer with a thickness of about 0.1 to 1 mm." See column 5, lines 5-10.

Clearly, the activated catalyst layer of Schuetz et al. has a non-uniform thickness.

(2) Distinctions between **claims 1, 18 and 20** and Schuetz et al.

The powder Raney catalyst according to inventive claims 1, 18 and 20 is characterized in that the lump form Raney catalyst (obtained by melting, quenching and molding a catalyst alloy raw material) which has been used as a hydrogenation catalyst is employed as a raw material.

The present Inventors have found that this is possible, since a lump form Raney catalyst that is a raw material of a powder Raney catalyst according to the present invention, as described above, has an unactivated (activateable) catalyst alloy layer within the catalyst. Then, the catalyst alloy, after it has been used in the fixed bed, is capable of efficiently being utilized as a hydrogenation catalyst. This concept of re-utilization has not previously existed.

Schuetz et al. disclose that the catalyst is used as a lump form or powdered form depending upon the degree of crushing. Schuetz et al. fail to teach or suggest that the powder catalyst is obtained from the already used catalyst as a raw material.

(3) Distinctions between **claims 1, 18 and 20** and Schuetz et al.; Raney et al. and Richter et al.

The present invention relates to a lump form Raney catalyst capable of being re-utilized to a powder catalyst and a powder Raney catalyst prepared from a used lump form Raney catalyst.

The invention that Schuetz et al. disclose is a catalyst manufactured by mixing a catalyst alloy powder with a catalyst metal powder playing the role as a binder and sintering it without melting the metal components. It is not a catalyst that is obtained by melting a catalyst raw material as in the present invention.

Raney et al. disclose that the metal is melted and cooled in order to obtain the Raney catalyst. However, Raney et al. fail to teach or suggest that the quenching is a cooling method of the melted catalyst alloy, and that a used catalyst is capable of being re-utilized.

The invention that Richter et al. disclose relates to a Raney alloy consisting of four elements including iron, titanium and zirconium. On the other hand, the present invention contains a small amount of molybdenum and tin (see claims 18-19), and the alloy consists primarily of nickel and aluminum. This composition is entirely different from the alloy of the present invention. It is known in the art that if the composition and ratio of metals in an alloy are changed, the physical properties, such as melting points, of the alloy can greatly differ.

Thus, Schuetz et al., Raney et al. and Richter et al. teach catalysts which are quite distinct from the present catalyst. In addition, those skilled in the art would not find the inventive catalyst obvious, based upon the disclosures of these cited references.

(I) (C) - Rejections (6)-(7)

(1) Distinctions between claims 5, 6 and 8 and Diffenbach et al.

Diffenbach et al. disclose that upon forming the Ni-Al based catalyst alloy, the melted catalyst alloy is dribbled into water and quenched.

Regarding the shape of the catalyst, in column 3, lines 27-47, Diffenbach et al. describe that

The basic technique most useful for alloy shaping is melt forming, that is, putting the alloy into a shape while in a melt condition with subsequent cooling to ambient temperatures... Particles of any of these types have proven to subsequently yield very active Raney catalysts.

Diffenbach intend to obtain a catalyst in a distorted shape.

However, as a result of this shape, there is very little of the catalyst which is reusable if crushed and activated as in the present invention.

On the other hand, the shape according to the present invention is different from that of the catalyst of Diffenbach et al., i.e., the inventive catalyst is not substantially in a distorted shape. Due to the unique shape of the inventive catalyst, the surface layer of the catalyst is activated at the time of the activation step, and it is possible to sufficiently contain the as yet activated catalyst alloy layer within the catalyst particles. As a result, the activated catalyst is capable of being re-utilized as a lump form Raney catalyst, and it is possible to re-utilize it

further as a powder Raney catalyst by crushing and activating the lump form Raney catalyst.

In the present invention, since the melting point of the alloy is high, the melted alloy droplets are dropped from the nozzle and quenched, resulting in a catalyst having a stable shape that is not distorted.

Thus, the catalysts of inventive claims 1, 5-10 and 18-21, which are defined in the product-by-process format, are patentable over the cited references, since the process limitations have been shown to actually form a product which is distinct from the product produced by the cited prior art. Accordingly, withdrawal of each of the rejections is respectfully requested.

CONCLUSION

In view of the above-amendments and comments, Applicants respectfully submit that the claims are in condition for allowance. A Notice to such effect is earnestly solicited.

If the Examiner has any questions concerning this application, she is requested to contact Garth M. Dahlen, Ph.D. (#43,575) at (703) 205-8000 in the Washington, D.C. area.

Pursuant to 37 CFR 1.17 and 1.136(a), the Applicants respectfully petitions for a three (3) month extension of time for

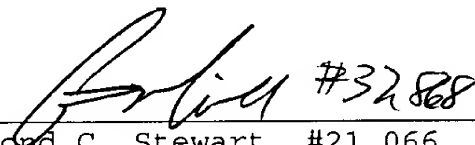
Appl. No. 09/197,499


filing a response in connection with the present application and the required fee of \$445.00 is attached hereto.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

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Attachment: Version with Marking to Show Changes Made

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Claim 6 has been deleted.

The claims have been amended as follows:

1. (Three Times Amended) A powder [type] Raney catalyst obtained by

(i) melting nickel and aluminum,

(ii) quenching droplets of said melted mixture by means of dropping them onto chilled water through a nozzle to obtain a quenched lump alloy,

(iii) optionally breaking the quenched lump alloy,

(iv) classifying and activating the alloy of step (ii) or (iii),

(v) using said alloy of step (iv) as a Raney catalyst in a hydrogenation reaction,

(vi) collecting said alloy of step (v),

(vii) crushing said Raney catalyst used in the hydrogenation reaction into powder, and

(viii) reactivating.

5. (Three Times Amended) A fixed bed catalyst consisting of a nickel aluminum alloy with molybdenum and/or tin up to 15% made by the process comprising

melting a mixture of nickel and aluminum,

quenching droplets of said melted mixture of nickel and aluminum by means of dropping them onto chilled water through a nozzle to form a quenched lump alloy which has the grain diameter of 1mm to 15mm,

[breaking said quenched lump alloy into particles,

classifying said quenched lump alloy particles by grain diameter,] and

activating said quenched lump alloy particles to form a Raney catalyst.

8. (Twice Amended) The Raney catalyst as defined in claim 5, wherein said nickel and said aluminum are present in an amount in a range of 1:2 to 2:1 by weight.

20. (Twice Amended) A powder Raney catalyst [made from the Raney catalyst defined in claim 5 further comprising after said activating step] consisting of a nickel aluminum alloy with molybdenum and/or tin up to 15% made by the process comprising

melting a mixture of nickel and aluminum,

quenching droplets of said melted mixture of nickel and aluminum by means of dropping them onto chilled water through a nozzle to form a quenched lump alloy which has the grain diameter of 1mm to 15mm,

activating said quenched lump alloy particles to form a Raney catalyst, and

crushing said Raney catalyst to form a powder.